

CLAIMS

1. An apparatus comprising
a nanoporous silicon support comprising a plurality of macropores
which support the viability of cells and
at least one individual cell within one of said plurality of
macropores,
wherein the support allows the cells to obtain nutrients and oxygen
sufficient to maintain the viability of the cells wherein the nutrients are
provided by culture medium.

2. The apparatus of claim 1, wherein the macropores have a
diameter between 0.2 and 200 microns.

3. The apparatus of claim 1, wherein the macropores have a
diameter between 0.2 and 150 microns.

4. The apparatus of claim 1, wherein the macropores have a
diameter between 15 and 25 microns.

5. The apparatus of claim 1, wherein the cells are eukaryotic cells.

6. The apparatus of claim 1, wherein the cells are hepatic cells.

7. The apparatus of claim 1, wherein the cells are prokaryotic cells.

8. The apparatus of claim 1, wherein the macropores are coated
with a coating substance selected from the group consisting of
biomolecules, peptides and proteins that promote cell adhesion on
biocompatible polymers.

2 9. The apparatus of claim 8, wherein the coating substance is
selected from the group consisting of collagen, fibronectin, vitronectin,
4 RGD and YIGSR peptides, glycosaminoglycans (GAGs), hyaluronic acid
(HA), integrins, selectins and cadherins.

6 10. The apparatus of claim 1, wherein the matrix is prepared using
a method selected from the group consisting of micromolding,
8 electrodeposition machining, laser ablation, laser drilling, micromaching,
wet etching, reactive ion etching, lithographic galvanic fabrication (LIGA)
10 and embossing.

12 11. The apparatus of claim 1, wherein the cells are perfused with
culture medium or buffered saline solution.

14 12. The apparatus of claim 1, wherein the direction of perfusion is
16 in any orientation relative to the support.

18 13. The apparatus of claim 1, wherein a plurality of supports
containing cells are used simultaneously in a single apparatus to increase
20 throughput of the apparatus.

22 14. A method for screening compounds for biological activity,
toxicity comprising adding a compound to an apparatus which comprises:
24 a nanoporous silicon support comprising a plurality of macropores
which support the viability of cells,
26 at least one individual cell within one of said plurality of
macropores, and
28 wherein the cells are provided with nutrients and oxygen sufficient
to maintain the viability of the cells and the cells are monitored for
30 changes in response to addition of the compound.

- 2 15. The method of claim 14, wherein the macropores have a
diameter between 0.2 and 200 microns.
- 4 16. The method of claim 14, wherein the macropores have a
diameter between 0.2 and 150 microns.
- 6 17. The method of claim 14, wherein the macropores have a
8 diameter between 15 and 25 microns.
- 10 18. The method of claim 14, wherein the cells are eukaryotic cells.
- 12 19. The method of claim 14, wherein the cells are hepatic cells.
- 14 20. The method of claim 14, wherein the cells are prokaryotic
cells.
- 16 21. The method of claim 14, wherein the macropores are coated
18 with a coating substance selected from the group consisting of
biomolecules, peptides and proteins that promote cell adhesion on
20 biocompatible polymers.
- 22 22. The method of claim 21, wherein the coating substance is
selected from the group consisting of collagen, fibronectin, vitronectin,
24 RGD and YIGSR peptides, GAGs, HA, integrins, selectins and cadherins.
- 26 23. The method of claim 14, wherein the matrix is prepared using
a method selected from the group consisting of micromolding,
28 electrodeposition machining, laser ablation, laser drilling, micromaching,
wet etching, reactive ion etching, LIGA and embossing.
- 30 24. The method of claim 14, wherein the cells are perfused with

culture medium or buffered saline solution.

25. The apparatus of claim 14, wherein the direction of perfusion is in any orientation relative to the support.

26. A method of claim 14, wherein multiple compounds are screened simultaneously for interactions.

27. A method for screening a compound for at least one activity under physiological conditions in a microarray comprising exposing cells in an apparatus which comprises a nanoporous silicon support comprising a plurality of macropores which support the viability of cells,
at least one individual cell within one of said plurality of macropores, and
wherein the support allows the cells to obtain nutrients and oxygen sufficient to maintain the viability of the cells exposed to a compound to be tested and screened for at least one effect of the compound on the cells.

28. A method for analysis of metabolism of a compound comprising exposing cells in an apparatus which comprises a nanoporous silicon support comprising a plurality of macropores which support the viability of cells,
at least one individual cell within one of said plurality of macropores,
wherein the support allows the cells to obtain nutrients and oxygen sufficient to maintain the viability of the cells exposed to a compound that may be metabolized by the cells,

wherein the nutrients are provided by the culture medium, and
wherein the metabolized compound is recovered from the culture medium for analysis.

29. A method for protein production comprising
exposing cells in an apparatus which comprises a nanoporous silicon support comprising a plurality of macropores which support the viability of cells,
at least one individual cell within one of said plurality of macropores,
wherein the support allows the cells to obtain nutrients and oxygen sufficient to maintain the viability of the cells expressing protein,
wherein the nutrients are provided by the culture medium, and
wherein the expressed protein is recovered from the culture medium.

30. A method to provide hepatic support comprising
exposing cells in an apparatus which comprises a nanoporous silicon support comprising a plurality of macropores which support the viability of cells,
a plurality of hepatocytes within said plurality of macropores,
wherein nutrients are provided by the blood or serum, and
wherein the support allows passage of blood or serum to allow bidirectional mass transfer of large molecular weight proteins sufficient to allow the fluid to be processed by the hepatocytes.